Field Screening for Shallow Gas in McHenry County, North Dakota

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The investigation of shallow natural gas occurrences within existing ground-water observation wells in McHenry County, North Dakota was conducted over a seven non-consecutive day period from July 31, and September 12, 13, 14, 15, 19, and 20, 2007. A total of 433 observation well sites, consisting of historic and existing ground-water observation wells, drilled in the county for the purposes of ground-water monitoring of unconfined and shallow confined aquifers, were revisited prior to the field component of this investigation. 393 of these observation well sites were selected to be visited in the field (3) to determine the actual existence of the well, (2) to verify its location, and (3) to perform flame ionization detector (FID) field screening for possible shallow natural gas occurrences. All observation well sites were not found during the investigation, suggesting that these wells have either been abandoned or destroyed. 393 observation well site locations were verified to have a ground-water observation well at their prescribed point and were subsequently field-screened.

Each of the wells were field screened for the presence of combustible gases using a portable FID infrared to methane (100 ppm low alarm or 10,000 ppm high alarm) in air. The FID was used solely for field screening on all wells. Instrument response was collected at the top of well casing (TOC) and just above the ground-water table (GWT), after the collection of a water level reading within the well using an electric well pump.

Of the existing wells field-screened, 51 returned positive FID responses, ranging from 0.3 to 2.233 ppm as methane, 29% of the wells showed no response (i.e., a 0.0 ppm as methane instrument reading) during field-screening at both the TOC and GWT. No wells were found to have a detectable concentration of methane at the TOC. It has been observed that it is more likely to detect methane at the GWI or higher up in the air column within a given well. It has been less typical to actually detect methane emanating from the TOC.

The occurrence of FID responses are variably distributed throughout the monitoring network in the central portion of the county trending from northwest to southeast following the ground-water flow direction being monitored. Such wells and individual private, irrigation, or municipal water supply wells were not considered as a part of this investigation.

FID field screening is not a stand-alone analytical tool. It must be used in conjunction with additional analytical methods and procedures. A positive FID instrument response indicates that the presence of methane is highly likely at the well since the instrument is specifically tuned to methane and is calibrated specifically to a predetermined concentration of methane in air. However, existence moisture and low oxygen levels or high values of carbon dioxide can influence FID response. A confirmatory gas analysis is required to determine and quantify the absolute presence and concentration of methane and other hydrocarbons that may be present in conjunction with FID field screening results.

The occurrence-level field screening results presented here are intended to aid in the selection of future candidate observation well locations and or means to conduct additional sampling and analysis and potentially focus future field investigative efforts.

Figure 1. Graph depicting the existence relationship and minimum values of FID instrument responses from selected wells in McHenry County. FID results for each well were presented in order of sampling occurrence from northwest to southeast. The typical concentration of methane in emanated natural gas is highlighted by the vertical green line at 1%

Explanation

Geologic Symbols

- Existing observation well with a positive numerical FID instrument response to parts per million (ppm) as methane, at the top of casing (TOC) and/or the ground-water table interface (GWI).
- Existing observation well, no FID response at TOC and/or the GWI.
- Well sites not visited during this investigation.
- Historical observation well location. No existing well at well site location visited. Well presumed abandoned or destroyed.
- Nested wells, locations not separate at this scale.

Other Features

- Water
- Irrigation
- Storms
- Roads
- Municipal